RoHS Compliant
Directive 2002/95/EC

Progressive scan CCD camera
KP-F500WCL
Specifications

1. General

KP-F500WCL are a CameraLink output system progressive san black and white CCD camera with a 2/3-inch size CCD and a full frame shutter.

The image of 2456 (H) x 2058 (V) is output at 16 frames per second.

The square lattice pixel format also provides excellent suitability for image processing applications.

2. Outstanding features

(1) High resolution

The 2/3-inch 5,000,000 pixels square lattice progressive scan CCD achieve a high resolution of 2456 (H) x 2058 (V).

(2) Small-sized camera

The camera has small SDR connector for digital outputs.

Therefore, the camera has the realization of small-sized shape of 44(W) x 44(H) x 41(D) mm.

(3) Remote control

- Multi-step electronic shutter (from 1/16 to 1/50000 second in 8 steps)
- Variable shutter (minimum 1/100000 second)
- Frame on demand (the image capture at desired timing using the external trigger signal)
- White spot correction, Right and left screen balance adjustment.

and other various functions are set by remote control via CameraLink cable.

(4) Automatic power supply change

The power supply through the camera link cable is possible from the PoCL frame grabber board. Because the power supply from the DCIN/SYNC connector is also possible, it is possible to make the camera work by using usual frame grabber board. The power supply from the DCIN/SYNC connector is given to priority when the power supply is supplied from both.

SYMBOL	DATE	DESCRIPTION	(DRAWN)	DESIGNED
-	Oct.29,2009	(first edition)	T.Ohsawa	K.Ueno

MODEL KP-F500WCL				TOLERANCE	Prod. Code - Order No.	
DESIGNED	DATE	APPROVED	DATE			
K. Ueno	Nov 11,09	M. Suzuki	Nov 12,09	UNIT	TITLE KP-F500WCL Specifications	REV. 0
CHECKED	DATE	STORED	DATE	SCALE		
T. Ohsawa	Nov 11,09	F. Morita	Nov 12,09			
Hitachi Kokusai Electric					DWG. No. E400192625	SHEET 1/26

3. Specifications

(1) Imaging device	2/3-inch interline CCD
Total pixels	2536 (H) x 2068(V)
Effective pixels	2456 (H) x 2058(V)
Pixel size	3.45 um (H) x 3.45 um (V) (square lattice)
(2) Sensing area	8.47 mm (H) x 7.10 mm (V)
(3) Scanning system	Progressive
(4) Aspect ratio	5 : 4
(5) Frame rate	16 frames/second (full pixel readout)
(6) Horizontal drive frequency	64.0000 MHz
(7) Horizontal scanning frequency	33.264 kHz
(8) Vertical scanning frequency	16.00 Hz (full pixel readout) 31.98 Hz (vertical 2 pixel addition mode)
(9) Sync system	Internal
(10) Lens mount	C mount
(11) Flange focal distance	17.526 mm
(12) Video output	Digital output (Camera Link) Base configuration: 64.0000 MHz x 2TAP Medium configuration: 32.0000 MHz x 4TAP Maximum cable length: 10 m Output image size: 2456(H) x 2058(V) (full pixel readout)
(13) Resolution	Horizontal/Vertical: 2000TV lines
(14) Sensitivity	500 lx, F11, 3200 K
(15) Minimum illumination	1.0 lx (F1.4, MAX GAIN)
(16) Signal noise to ratio	48 dB
(17) Electric shutter	OFF, 1/16, 1/60, 1/100, 1/250, 1/1000, 1/2000, 1/10000, 1/50000 second. OFF is normal exposure (frame rate) or changeable by variable shutter (Minimum 1/100000second)
(18) Gamma	γ = 1
(19) Frame on demand	
Mode	(A) Fixed shutter mode (8 steps or variable) (B) ONE trigger mode (C) VD reset mode
Trigger input	CameraLink (CC1) or DCIN/SYNC connector
(20) Partial scan	Selectable start position and width of picture grabbing in 1H step.
(21) Power supply voltage	12 ± 1 VDC
(22) Current consumption	Approx. 260 mA (Approx. 3.1W) *When partial scan is ON, Approx. 330 mA (Approx. 4.0W)

(23) Ambient	Performance	0 to +40 □ (+32 to +104 F), less than 90 % RH
	Operation	-10 to +50 □ (+14 to 122 F), less than 90 % RH
	Storage	-20 to +60 □ (-4 to 140 F), less than 70 % RH (without dew condensation)
(24) Vibration endurance		10 to 55 Hz (2.37 to 71.7 m/s^2), sweep: 1 min XYZ 30min
(25) Shock endurance		490.3 m/s^2 (Drop test, once each top, bottom, left and right)
(26) External dimensions		44 (W) x 44 (H) x 41 (D) mm (Not including protrusions)
(27) Mass		Approx. 110 g

(28) Remote control

(a) Signal system

Control system	Start-stop synchronization system
Transmission rate	9600 bps
Data length	8 bits
Start bit	1bit
Stop bit	1bit
Parity	None
Bit transfer	LSB first

(b) Communications control system

Full control by remote control software, data send/receive by text data transfer to camera microprocessor (BSC system handshake)

(c) Control items

1. Shutter speed	OFF, 1/16, 1/60, 1/100, 1/250, 1/1000, 1/2000, 1/10000, 1/50000 second Factory setting: OFF
2. Variable shutter	10 to 1/100000 second
3. Mode	OFF, Fixed shutter, One trigger and VD reset mode Factory setting: OFF
4. Vertical 2 pixel addition	On / Off Factory setting: OFF
5. Gain	0 to 18 dB (Approx. 0.0358 dB step) Factory setting: 0 dB
6. VD/FVAL	Factory setting: FVAL
7. HD/LVAL/LVAL2	Factory setting: LVAL
8. 12bit / 10bit / 8bit	Factory setting: 8bit
9. Partial scan	Factory setting: OFF
10. Offset level	Factory setting: 0/1023
11. Trigger pulse polarity	Factory setting: POS
12. Base / Medium configuration	Factory setting: Base
13. Trigger input	CameraLink (CC1) or DCIN/SYNC connector Factory setting: CC1
14. Output signal	OFF, FLASH OUT and VD OUT Factory setting: OFF
15. White spot correction	ON / OFF Factory setting: ON
16. Balance adjust	OFF / MANUAL / AUTO Factory setting: AUTO
17. Test pattern	OFF / H-LAMP / V-LAMP / HV-LAMP Factory setting: OFF
18. Output order substitution	ON/OFF Factory setting: OFF
19. Factory set	Return to the factory settings.

4. Composition

(1) Camera (with Dummy glass)

(2) CD-ROM(Operation manual, Control software)

(3) Composition table

5. Optional accessories

(1) Dummy glass (AR coated)	ARC1214
(2) IR cut filter	IRC650
(3) Junction box	JU-F30
(4) Tripod adaptor	TA-F500
(5) 12pin plug	HR10A-10P-12S(01)

(6) Camera cable

	Molded type	Shield type
2 m	C-201KSM	C-201KSS
5 m	C-501KSM	C-501KSS
10 m	C-102KSM	C-102KSS

In the CE Marking region, use the shield type and install clamp filter （ZCAT2035-0930A: TDK） at both ends of the cable.

(7) Digital out cable

Cable length	Model name	
	SDR-SDR type	SDR-MDR type
1m	C-101PCL (SS)	C-101PCL (SM)
2m	C-201PCL (SS)	C-201PCL (SM)
3m	C-301PCL (SS)	C-301PCL (SM)
5m	C-501PCL (SS)	C-501PCL (SM)

SDR: Shrunk Delta Ribbon

MDR: Miniature Delta Ribbon

6. Signal connection to connector

(1) Signal connection to DCIN/SYNC connector

PIN No.	Internal SYNC mode	PIN No.	Internal SYNC mode
1	GND	7	Trigger IN/ VD IN
2	---- (PoCL)	8	GND
	+12V (non-PoCL)		
3	GND	9	----
4	----	10	FLASH OUT / VD OUT
5	GND	11	----
6	----	12	GND

Plug (matching cable plug)　　Hirose HR10A-10P-12S(01) or equivalent

(Note) Please do not unplug and insert cable (camera cable) with a power supplied to a camera. Install clamp filter (ZCAT 2035-0930A: TDK) at both ends (camera and video processor ends) in the CE marking region.

(2) Signal connection to DIGITAL OUT connector

D.OUT 1

Pin No.	Signal	Pin No.	Signal
1	+12V (PoCL) GND (non-PoCL)	14	GND
2	TXOUT 0 (−)	15	TXOUT 0 (+)
3	TXOUT 1 (−)	16	TXOUT 1 (+)
4	TXOUT 2 (−)	17	TXOUT 2 (+)
5	TXCLKOUT (−)	18	TXCLKOUT (+)
6	TXOUT 3 (−)	19	TXOUT 3 (+)
7	RX (+) [SERTC (+)]	20	RX (−) [SERTC (−)]
8	TX (−) [SERTFG (−)]	21	TX (+) [SERTFG (+)]
9	TRIG/VD (−) [CC1 (−)]	22	TRIG/VD (+) [CC1 (+)]
10	NC [CC2 (+)]	23	NC [CC2 (−)]
11	NC [CC3 (−)]	24	NC [CC3 (+)]
12	NC [CC4 (+)]	25	NC [CC4 (−)]
13	GND	26	+12V (PoCL) GND (non-PoCL)

D.OUT 2

Pin No.	Signal	Pin No.	Signal
1	+12V (PoCL) GND (non-PoCL)	14	GND
2	TYOUT 0 (−)	15	TYOUT 0 (+)
3	TYOUT 1 (−)	16	TYOUT 1 (+)
4	TYOUT 2 (−)	17	TYOUT 2 (+)
5	TYCLKOUT (−)	18	TYCLKOUT (+)
6	TYOUT 3 (−)	19	TYOUT 3 (+)
7	N.U.	20	N.U.
8	N.U.	21	N.U.
9	N.U.	22	N.U.
10	N.U.	23	N.U.
11	N.U.	24	N.U.
12	N.U.	25	N.U.
13	GND	26	+12V (PoCL) GND (non-PoCL)

Connector (camera side) Sumitomo 3M 1226-1100-00PL or equivalent

N.U.: Not used

- D.OUT2 is used for Medium configuration.
- The digital out cable should be comprised of a twisted pair of wires having 100 ohm characteristic impedance and an outer sheath shield type conductor.
- Connect the shield (ground) of the digital out cable to the ground terminal of the video equipment, frame grabber, etc.
- Install clamp filter (ZCAT2035-0930A: TDK) at both ends (camera and video processor ends) in the CE marking region.
- TX: Transmit data from camera to machine
- RX: Transmit data from machine to camera

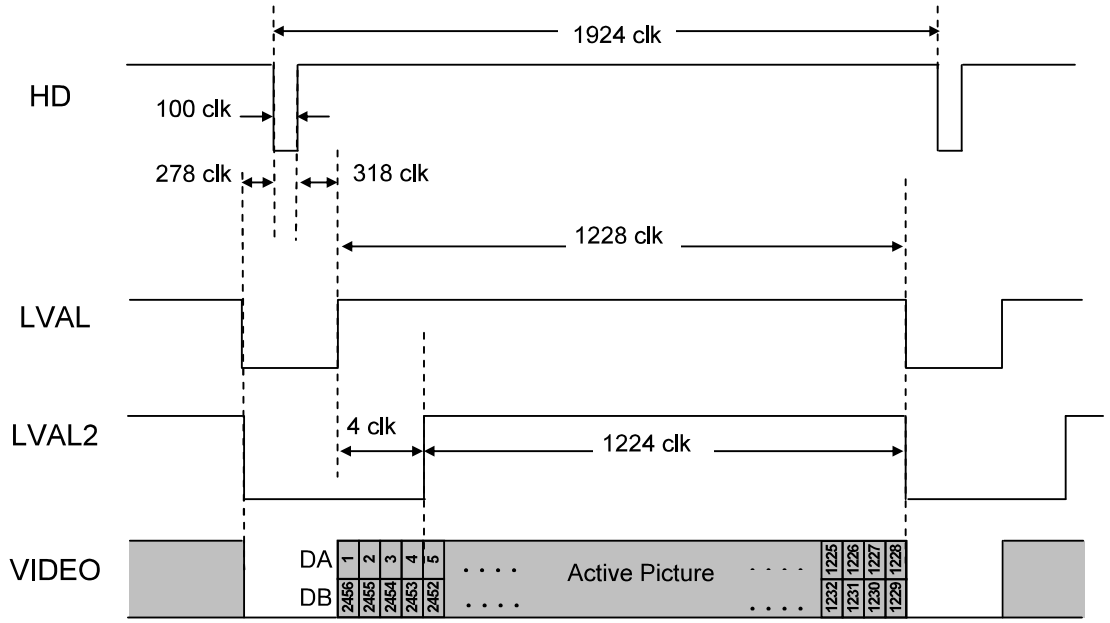
(Note) Please do not unplug and insert cable (digital out cable) with a power supplied to a camera.

7. CameraLink output

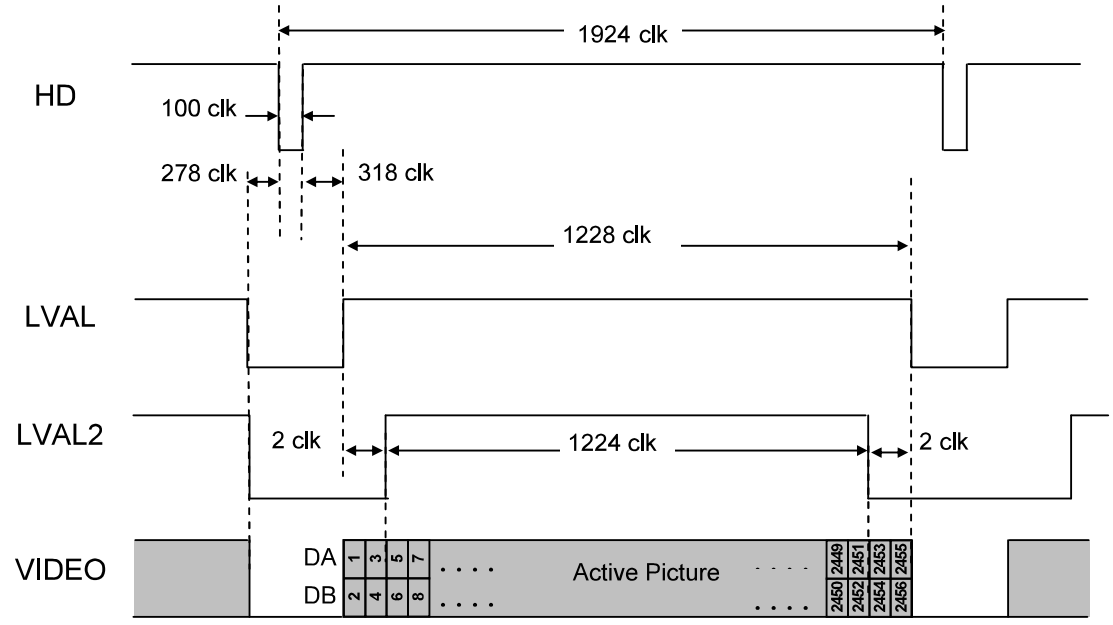
7-1. Horizontal timing

(1) Base configuration（1 clk = 15.625 ns）

(a) SORT OFF

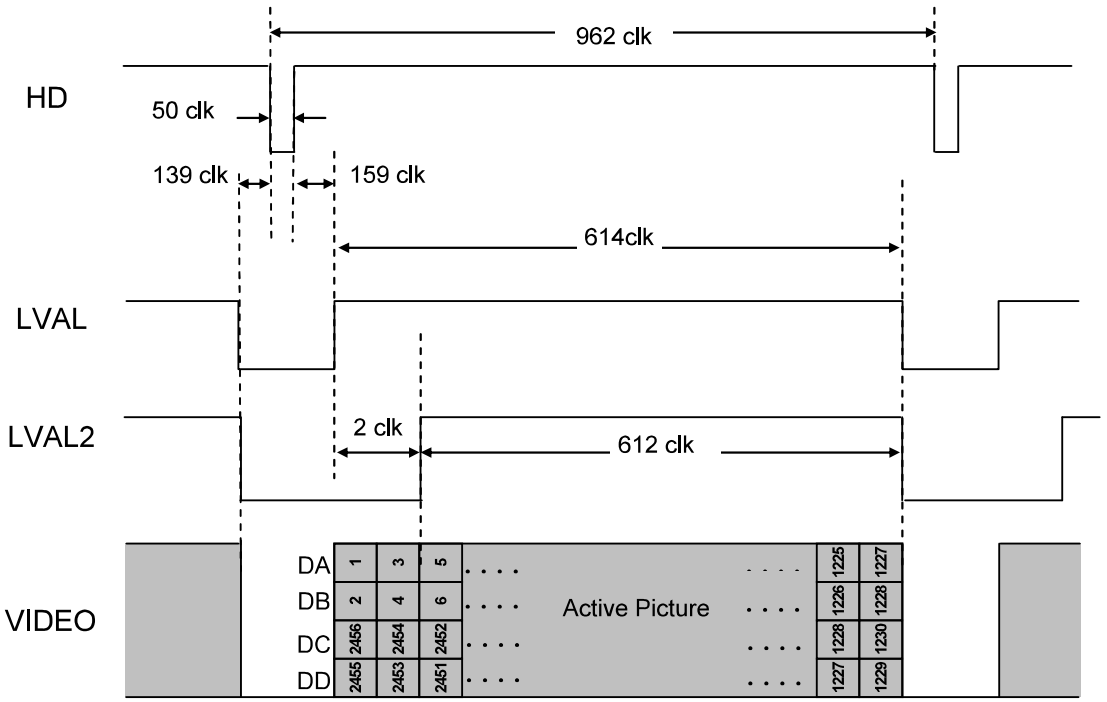


(b) SORT ON

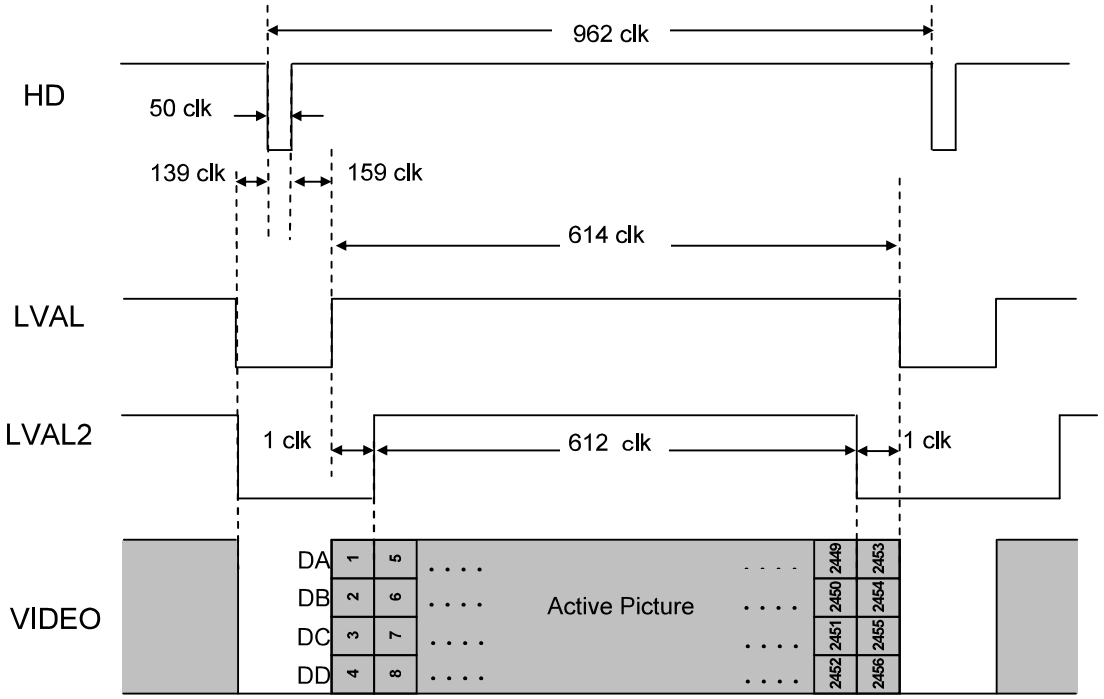


(2) Medium configuration （1 clk = 31.25 ns）

(a) SORT OFF



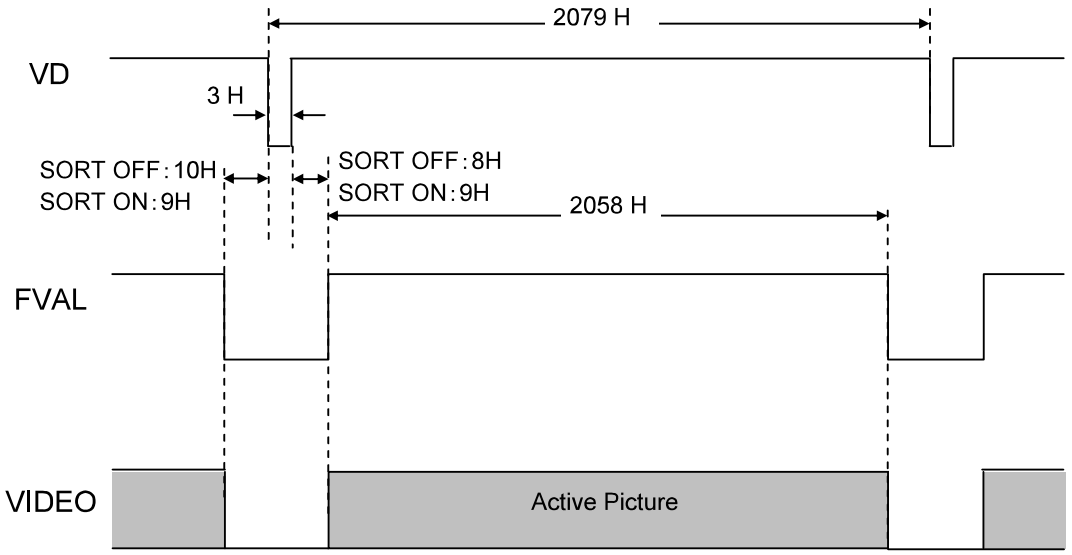
(b) SORT ON



DWG. No. E400192625

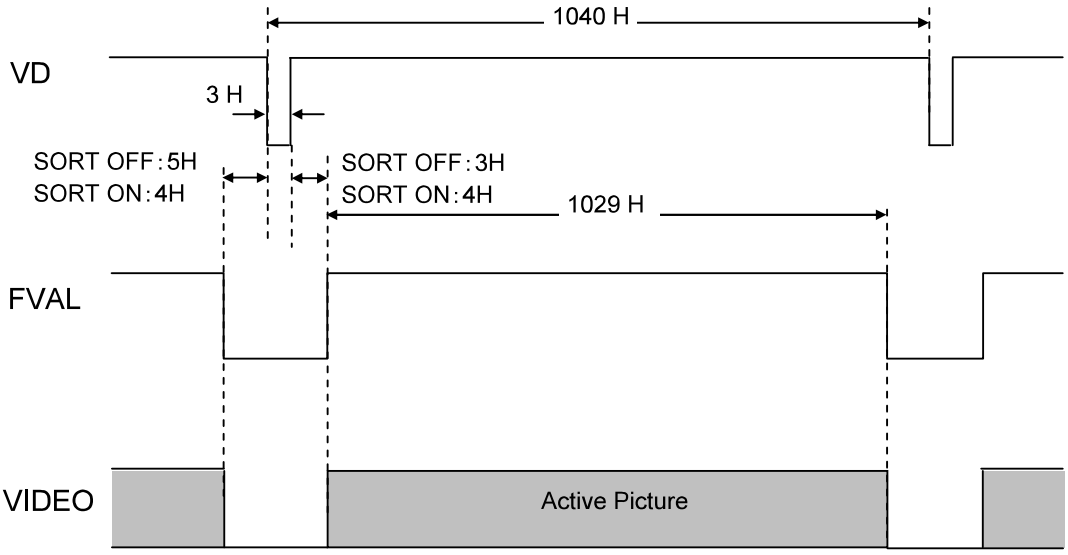
SHEET 9 / 26

7-2. Vertical timing



1H = 1924clk = 30.06 μ s

* Vertical timing for vertical 2 pixel addition mode

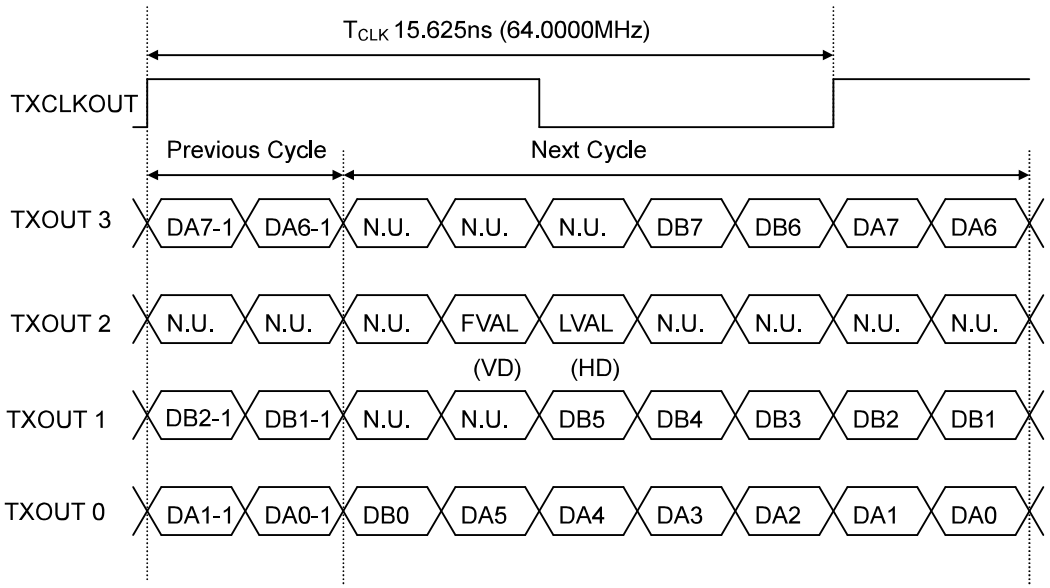


7-3. Transmitter LVDS output pulse position measurement

(1)Base configuration

(a)8bit

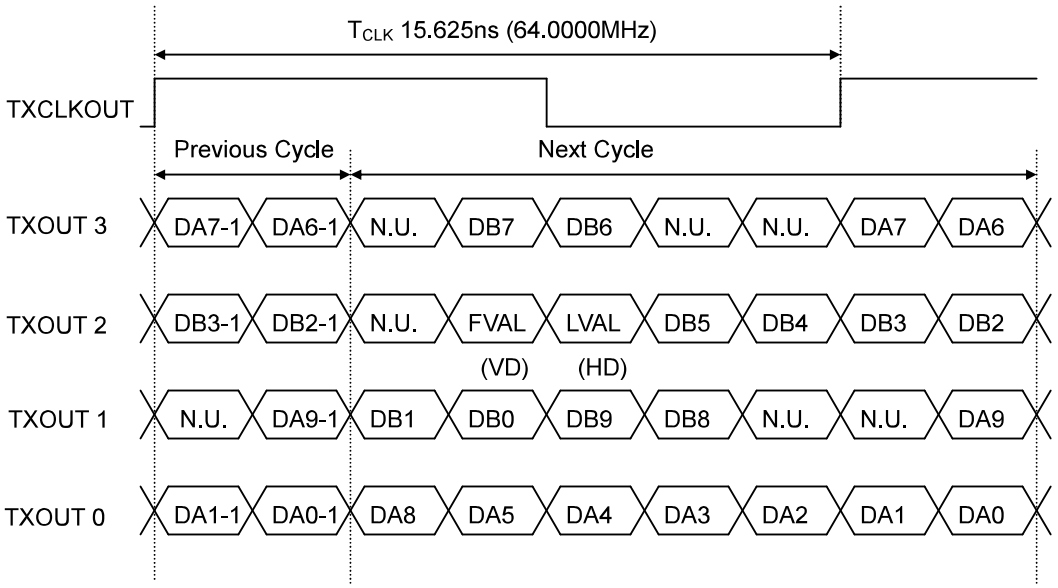
D.OUT1



N.U.: Not used

(b)10bit

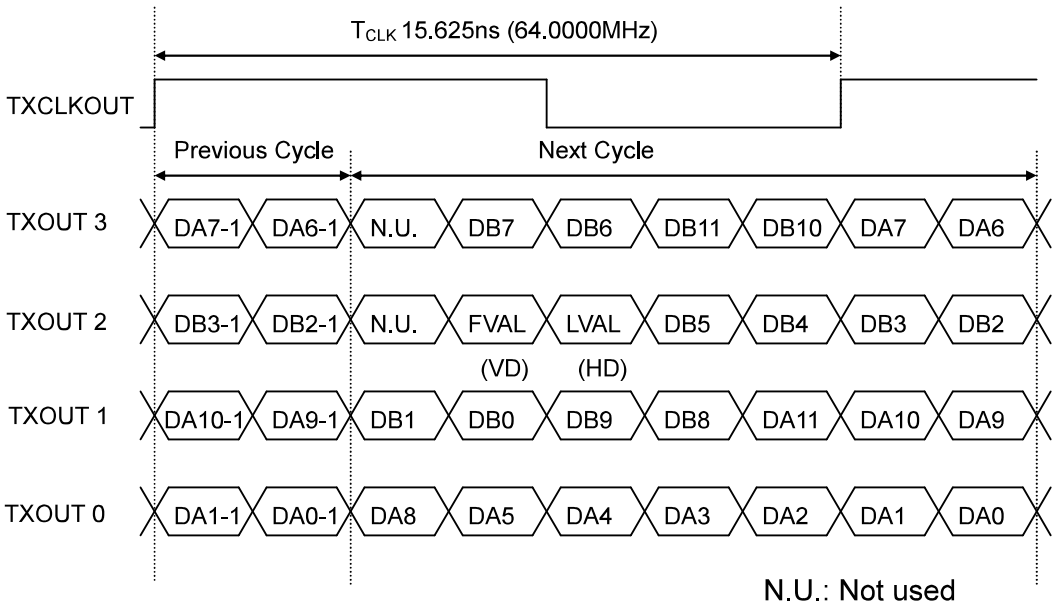
D.OUT1



N.U.: Not used

(c)12bit

D.OUT1

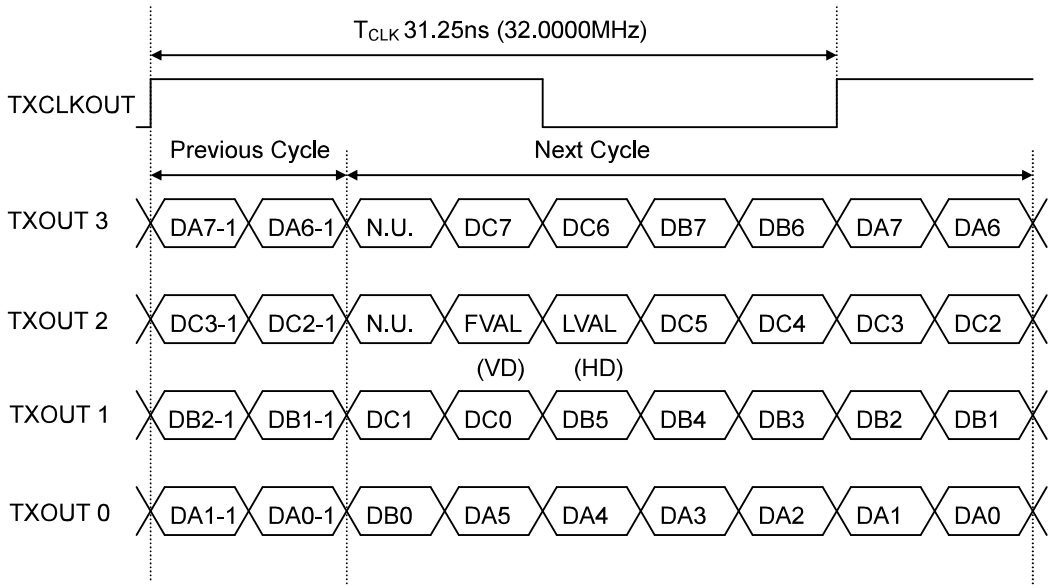


* When using Base configuration, please be sure to connect to CameraLink cable to D.OUT1.
If the cable is connected to D.OUT2, the machine may break down.

(2) Medium configuration

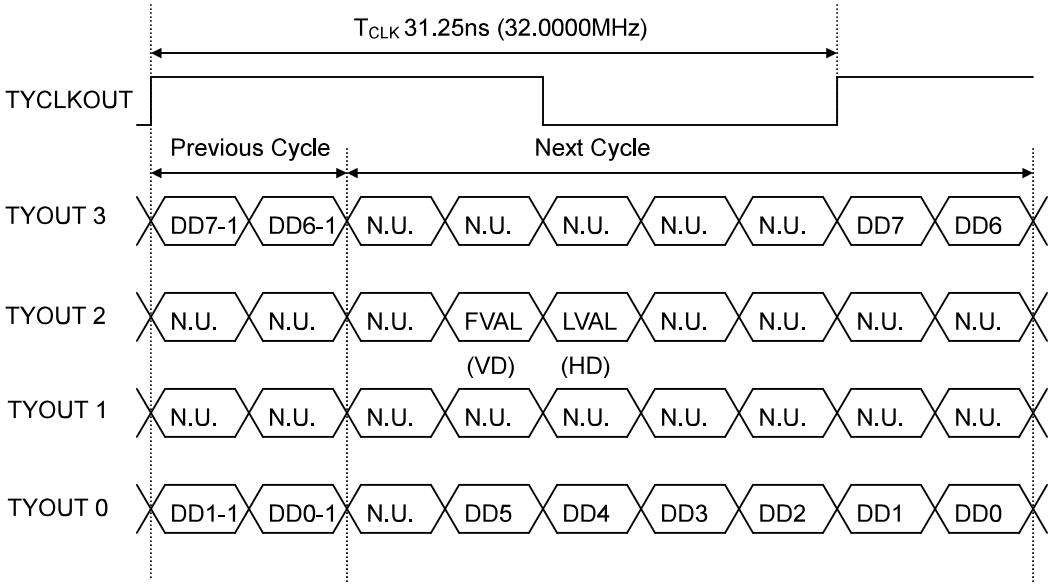
(a)8bit

D.OUT1



N.U.: Not used

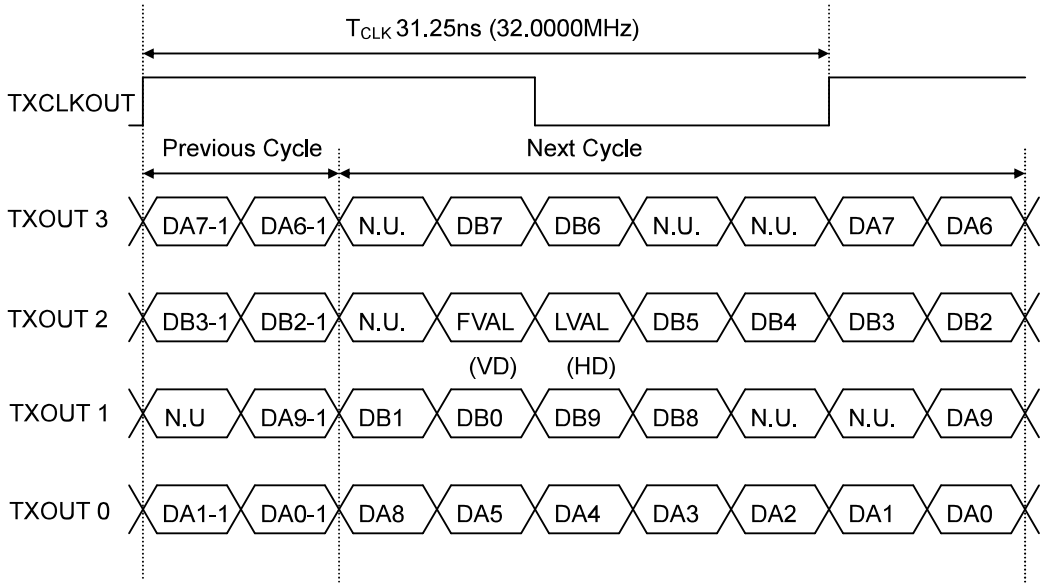
D.OUT2



N.U.: Not used

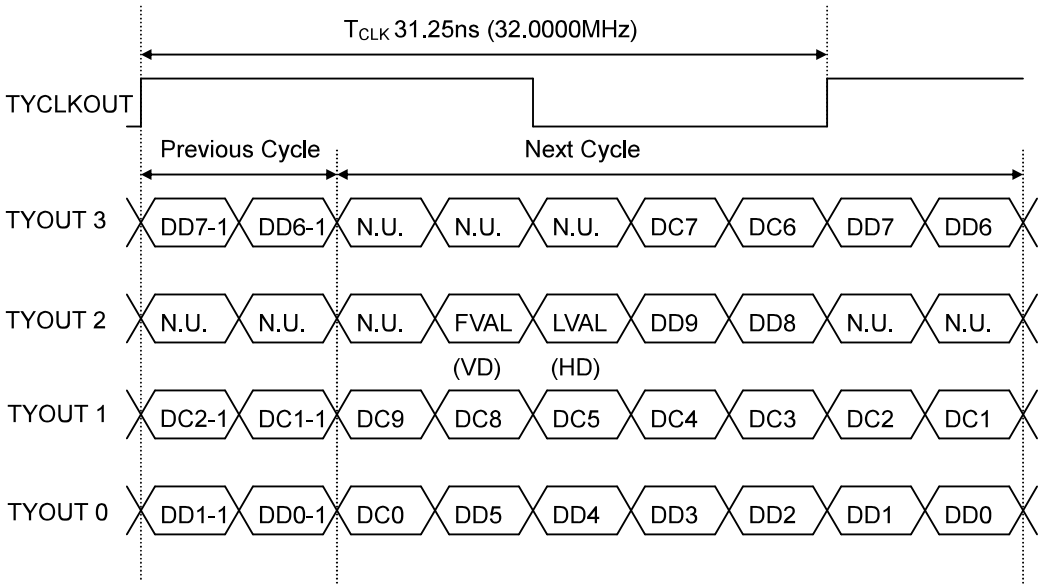
(b)10bit

D.OUT1



N.U.: Not used

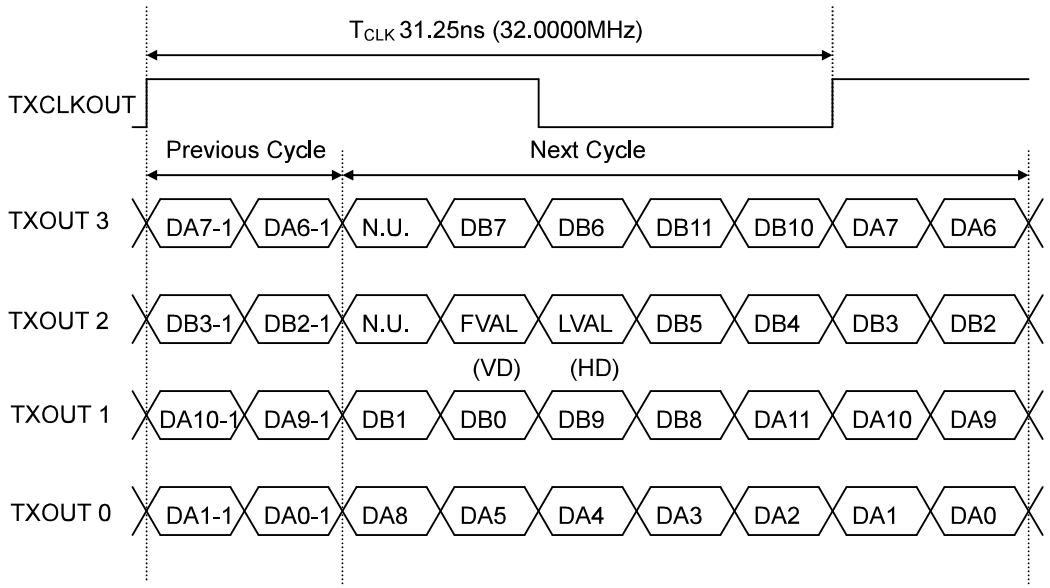
D.OUT2



N.U.: Not used

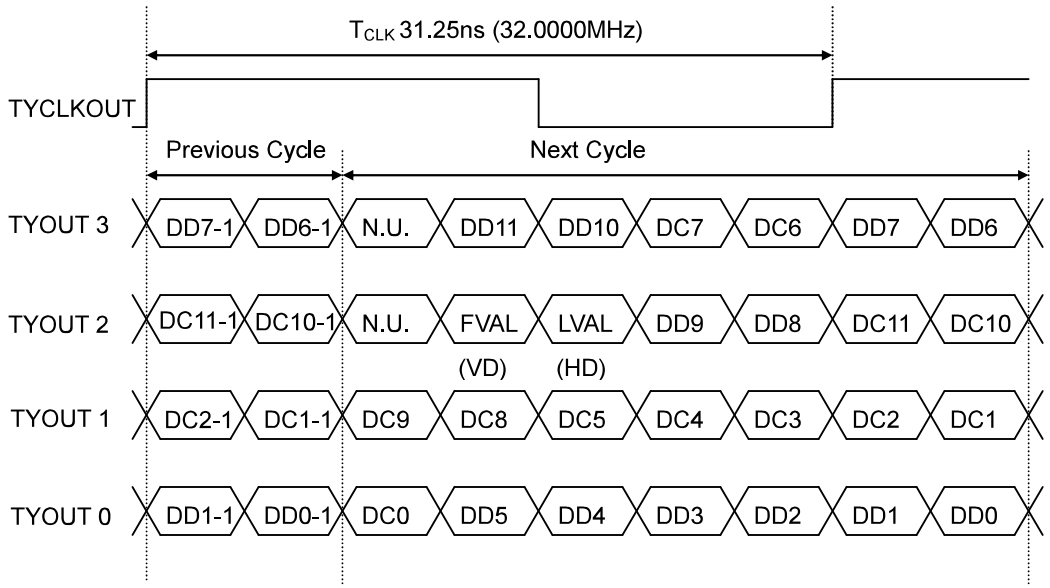
(c)12bit

D.OUT1



N.U.: Not used

D.OUT2



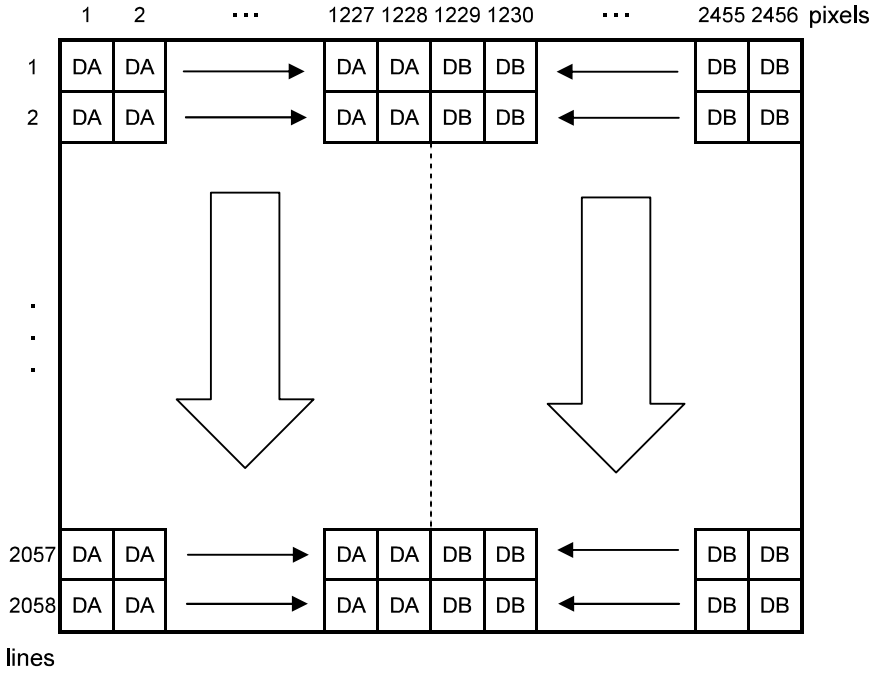
N.U.: Not used

7-4. Output sequence

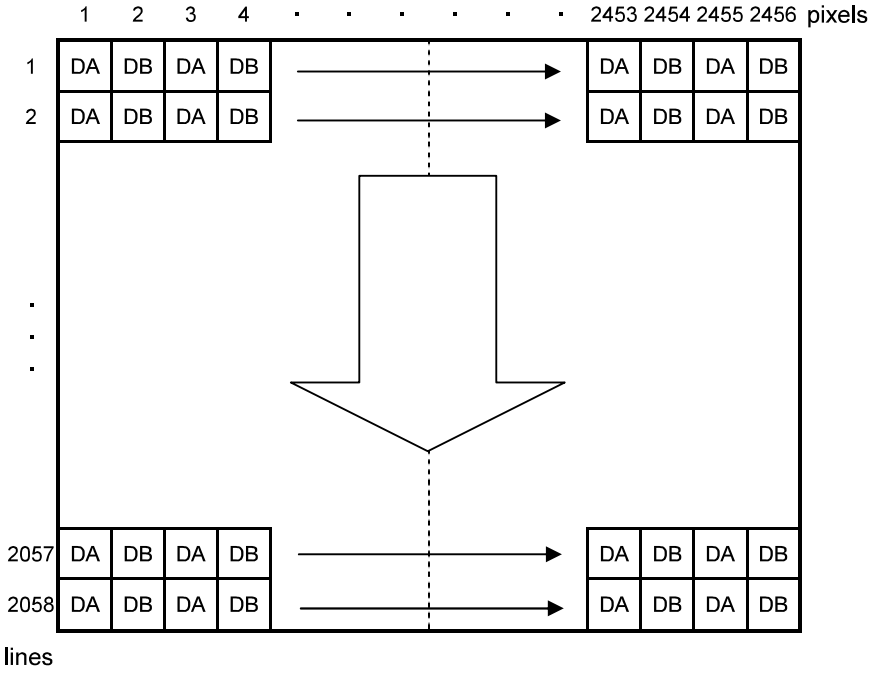
DA, DB, DC, and DD show output TAP of the cameralink.
Refer to " Transmitter LVDS output pulse position measurement " for details.

(1) Base configuration

(a) SORT OFF

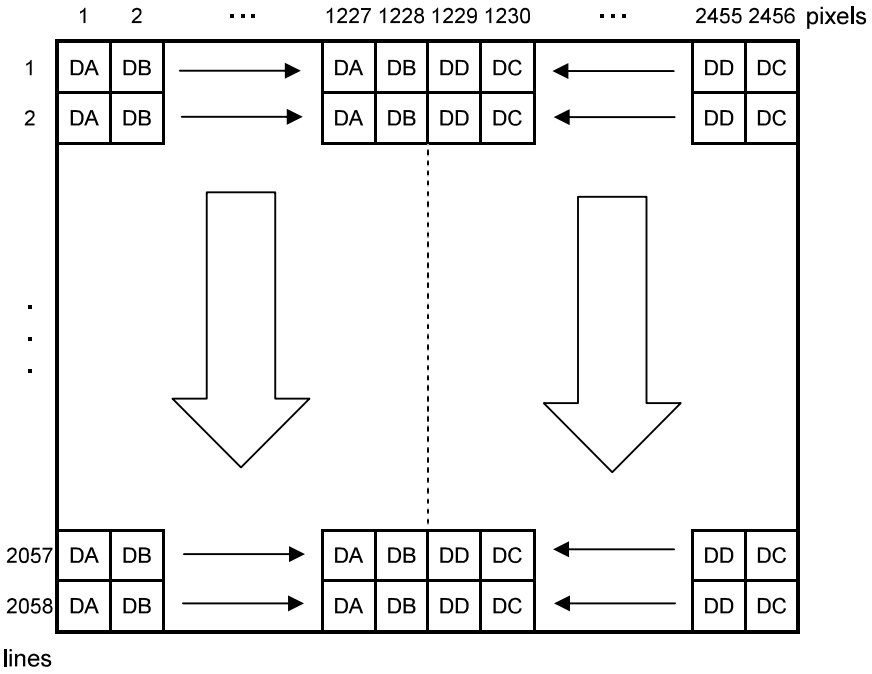


(b) SORT ON

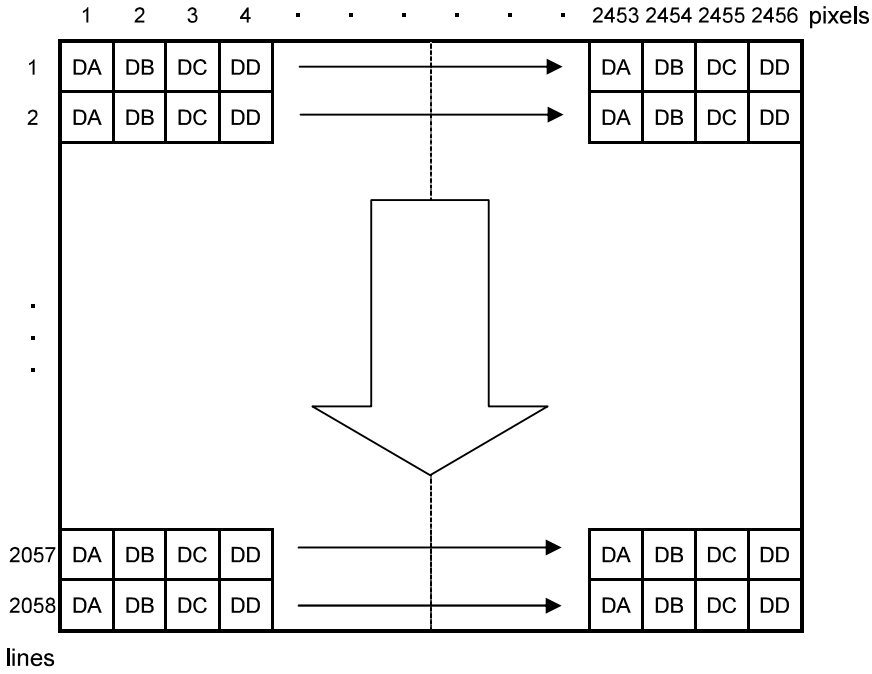


(2) Medium configuration

(a) SORT OFF



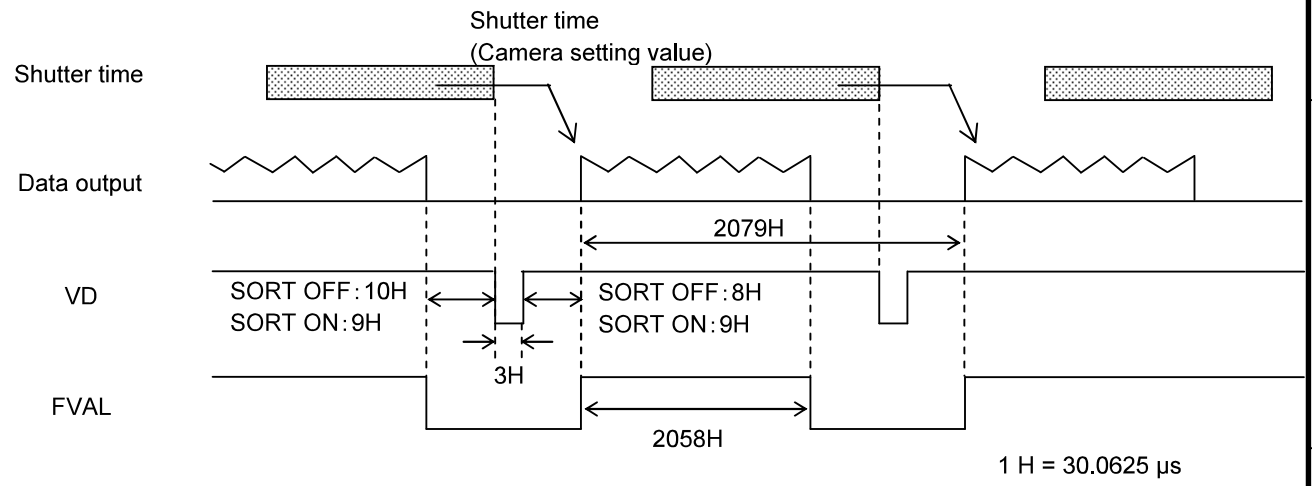
(b) SORT ON



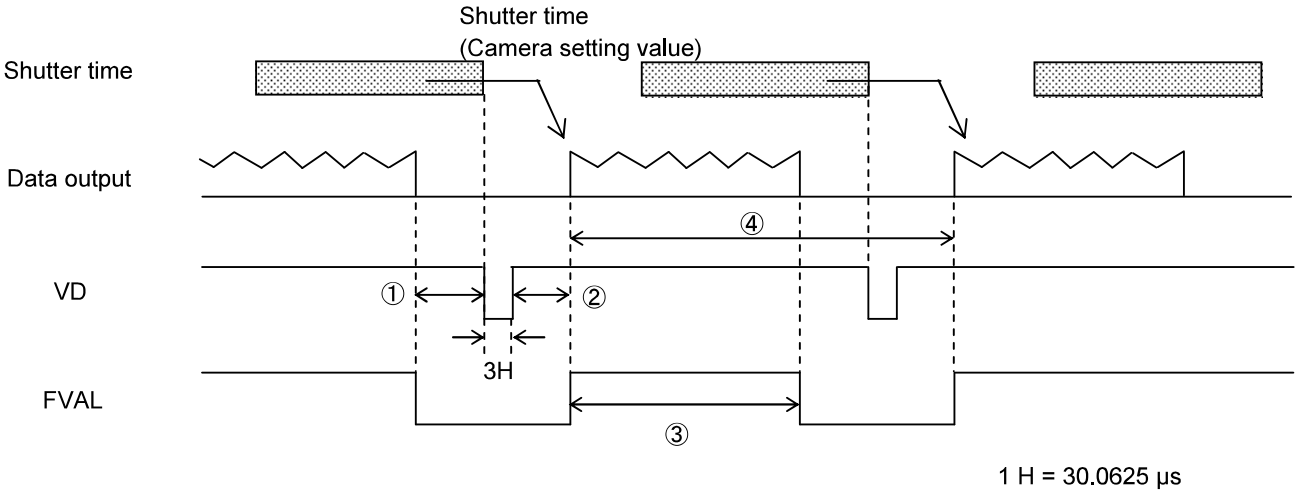
8. Timing chart

8-1. Normal mode

(a) Partial scan OFF



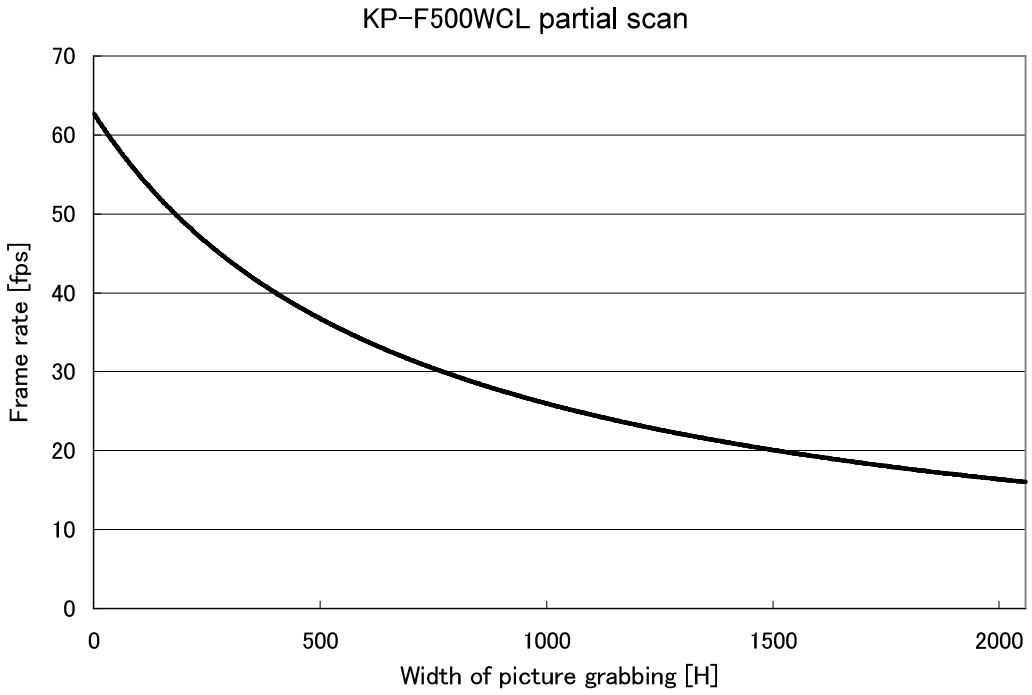
(b) Partial scan ON



① to ④ are variable by start position of picture grabbing and width of picture grabbing (omit the figures after the decimal fractions).

	SORT OFF	SORT ON
①	(3 + (2067-Width)/4 - Start/4)H	(2 + (2067- Width)/4 - Start/4)H
②	(8 + Start/4)H	(9 + Start/4)H
③	(Width) H	
④	(14+ Width +(2067- Width/4))H	

Graph following shows frame rate in each width of picture grabbing when partial scan is ON.



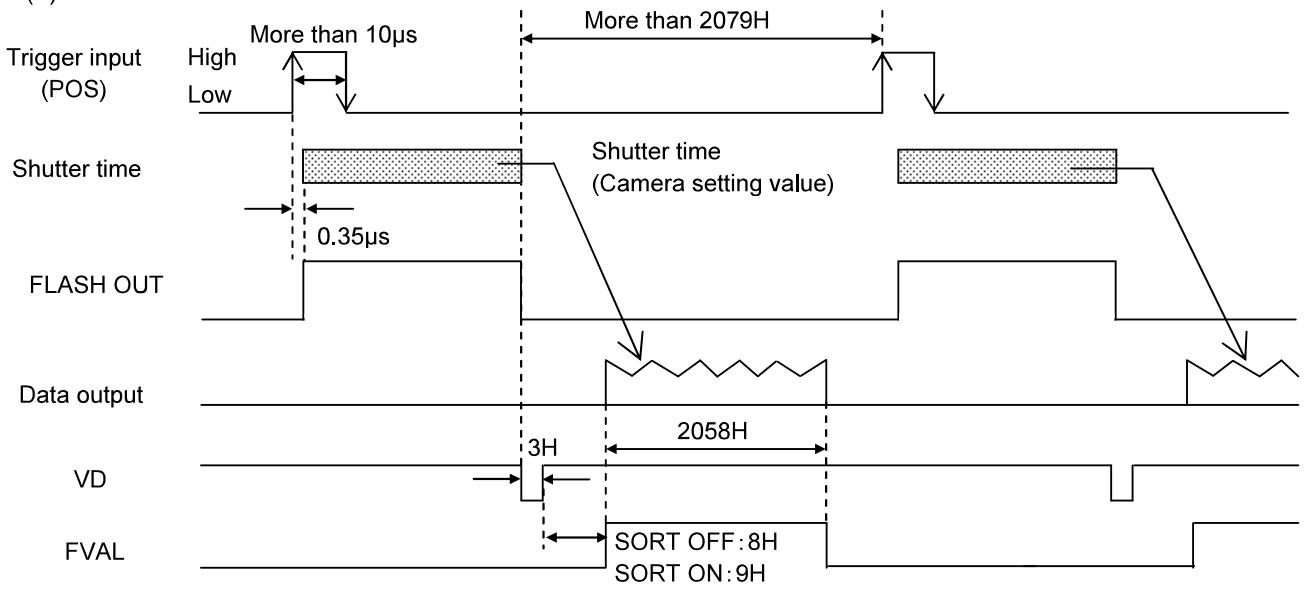
Note: Frame rate can be calculated from following equations using width of picture grabbing.
Lines = 14 + Width + (2067 - Width) / 4
Frame rate = (64000000 / 1924) / Lines

*Notes when partial scanning is used
Note1: Please use the partial scan in following condition.
Start + Width ≦ 2059
Note2: Please use FVAL in the partial scan.

8-2. Fixed shutter mode

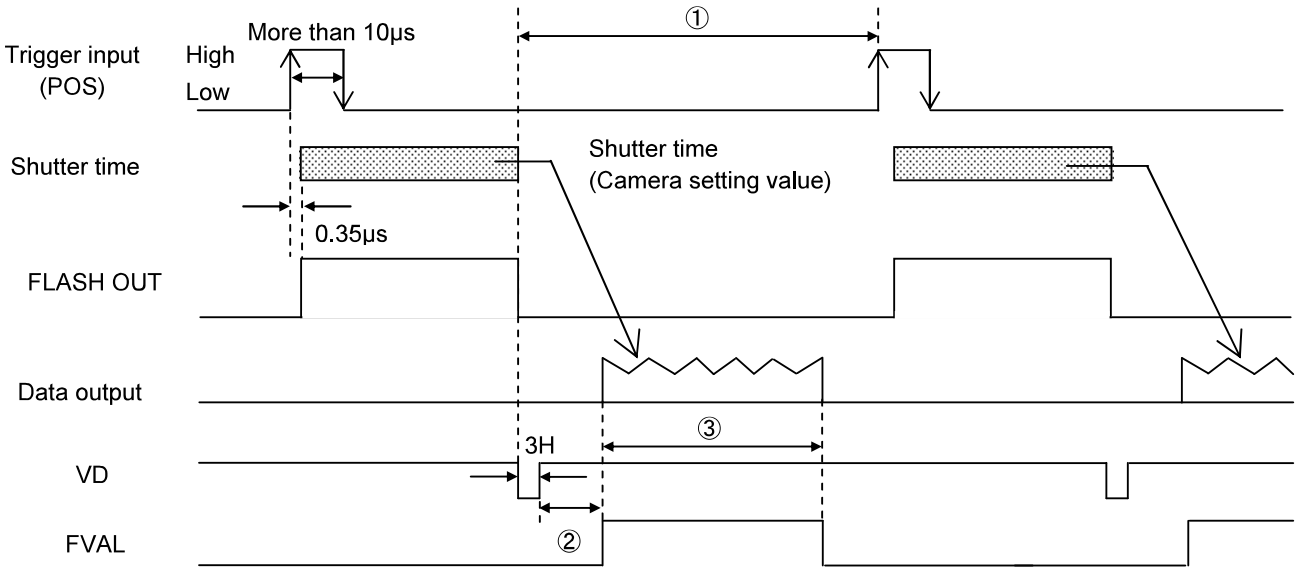
When external trigger signal is POSITIVE, after the trigger signal rise, exposure is start. The exposure time is set by the camera electronic shutter speed. The video output is obtained immediately after the end of fixed exposure. The strobe signal start/end can be set to shutter time.

(a) Partial scan OFF



1 H = 30.0625 µs

(b) Partial scan ON



1 H = 30.0625 µs

① to ③ are variable by start position of picture grabbing and width of picture grabbing (omit the figures after the decimal fractions).

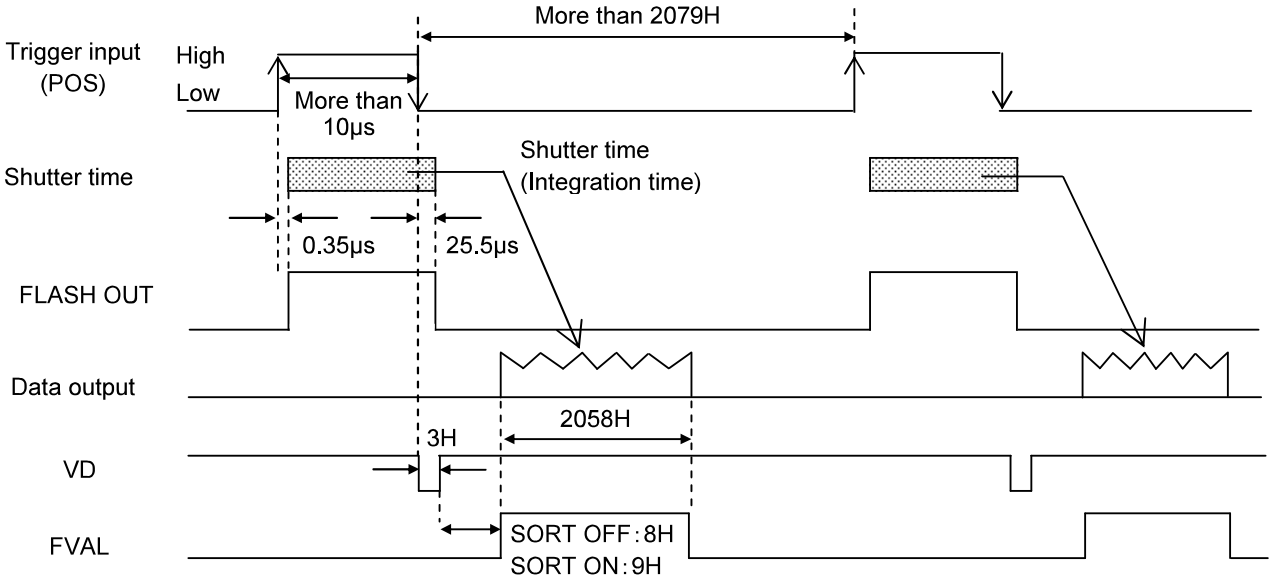
	SORT OFF	SORT ON
①	(14 + Width + (2067 - Width/4)) H or more	
②	(8 + Start/4)H	(9 + Start/4)H
③	(Width)H	

Neither the influence on the output image nor the change of the exposure time occur even if the trigger signal inputs it while outputting the image. However, the delay might occur in the exposure beginning within the range of 1H or less.

8-3. ONE trigger mode

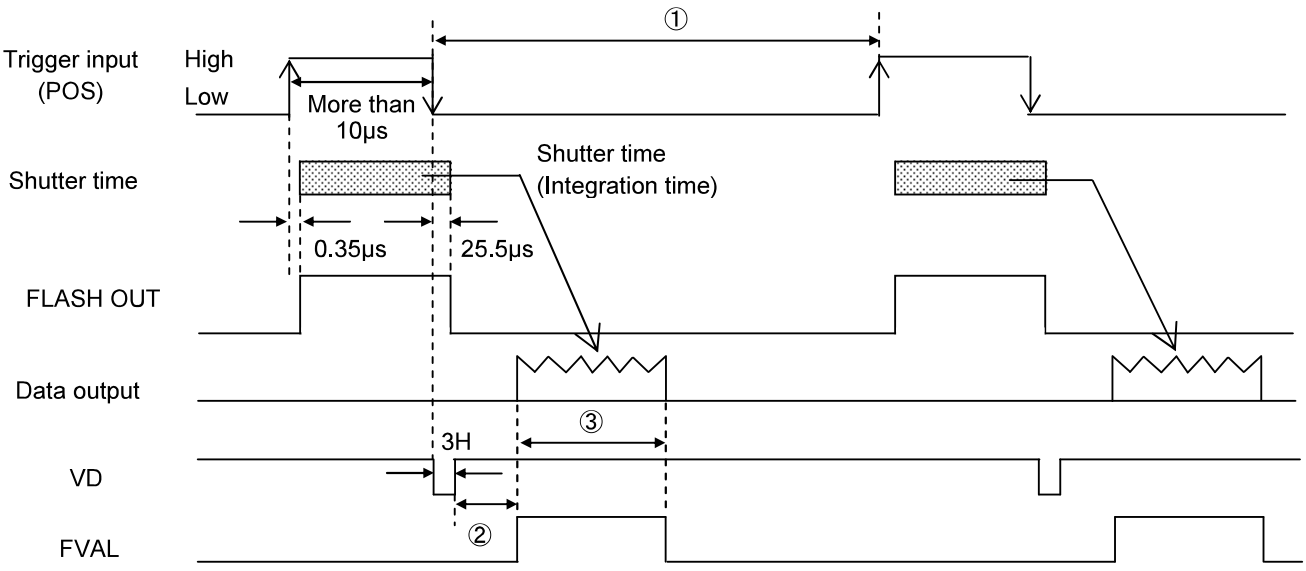
When external trigger signal is POSITIVE, after the trigger signal rise, exposure is start. At the trigger signal falling edge, the internal VD signal is reset and the video data are transmitted. The trigger signal width equals the exposure time.

(a) Partial scan OFF



1 H = 30.0625 µs

(b) Partial scan ON



1 H = 30.0625 µs

① to ③ are variable by start position of picture grabbing and width of picture grabbing (omit the figures after the decimal fractions).

	SORT OFF	SORT ON
①	(14 + Width + (2067 - Width/4)) H or more	
②	(8 + Start/4)H	(9 + Start/4)H
③	(Width)H	

There is no influence in the output image even if the trigger signal inputs it while outputting the image. However, the exposure time might increase within the range of 1H or less.

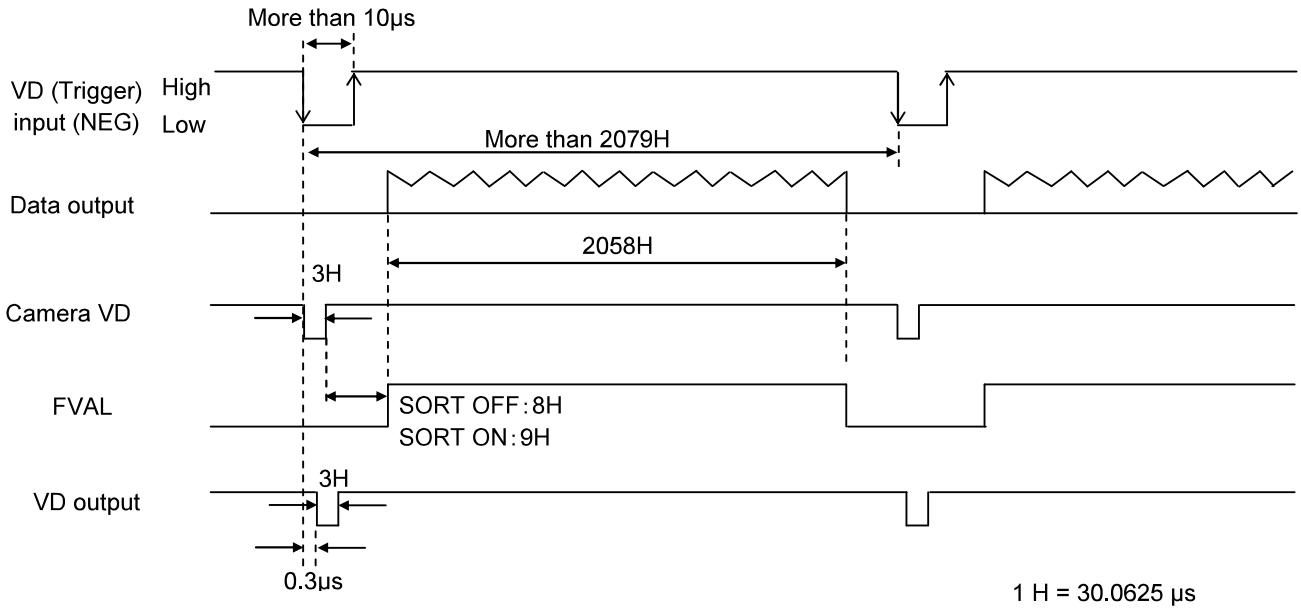
8-4. VD reset mode

When external VD pulse is inputted, internal HD/VD is reset.

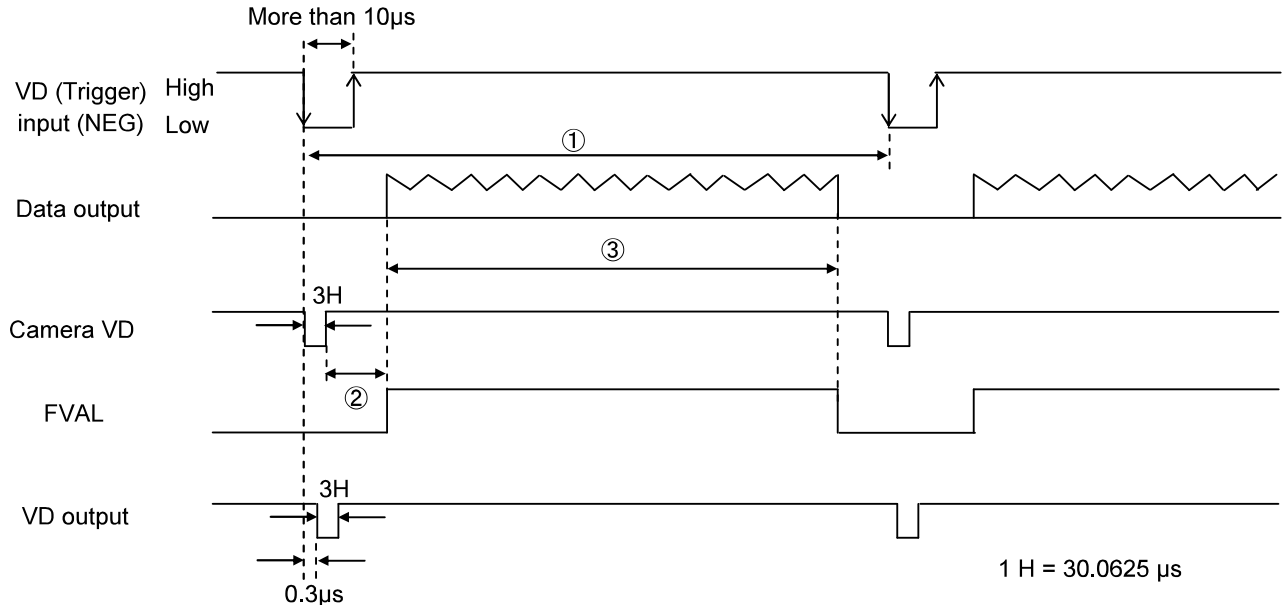
*Note: When external VD of 16.00 Hz or more is input, electronic shutter has an equation between external VD and 16.00 Hz.

(a) Partial scan OFF

External VD specification: 16.00 Hz or less



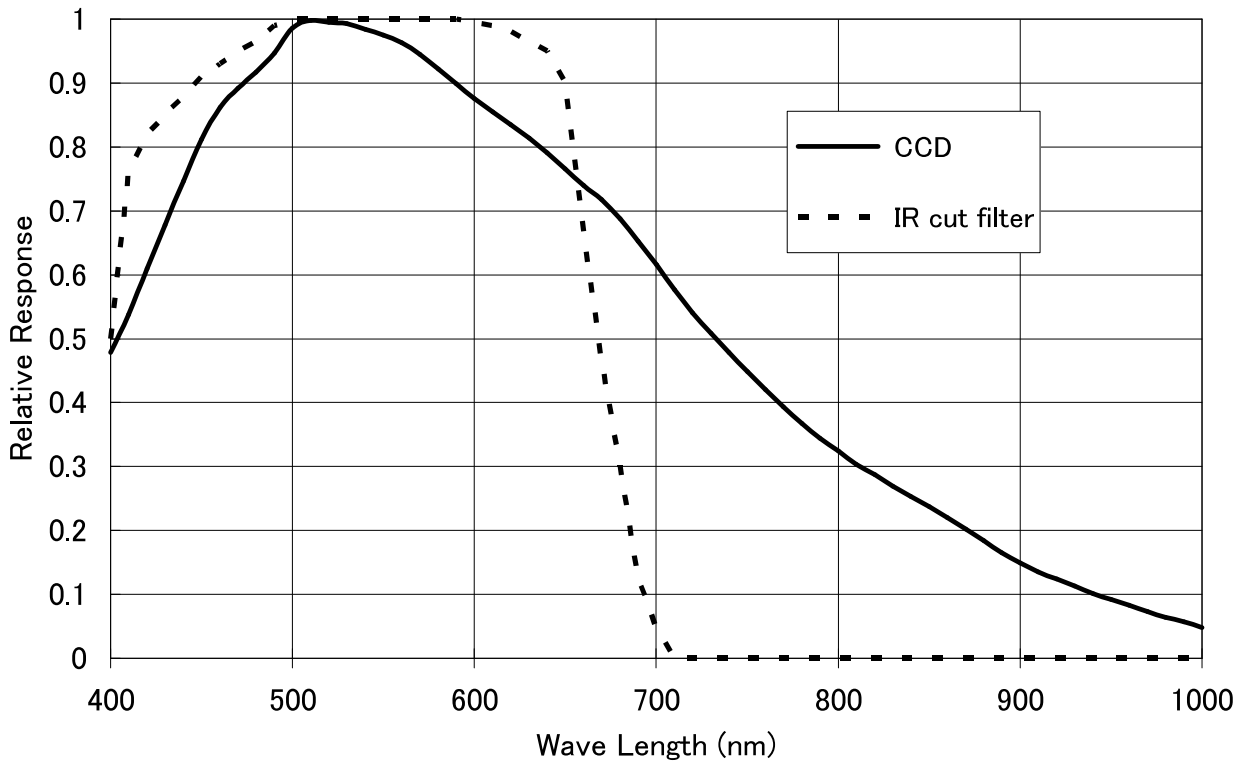
(b) Partial scan ON



① to ③ are variable by start position of picture grabbing and width of picture grabbing (omit the figures after the decimal fractions).

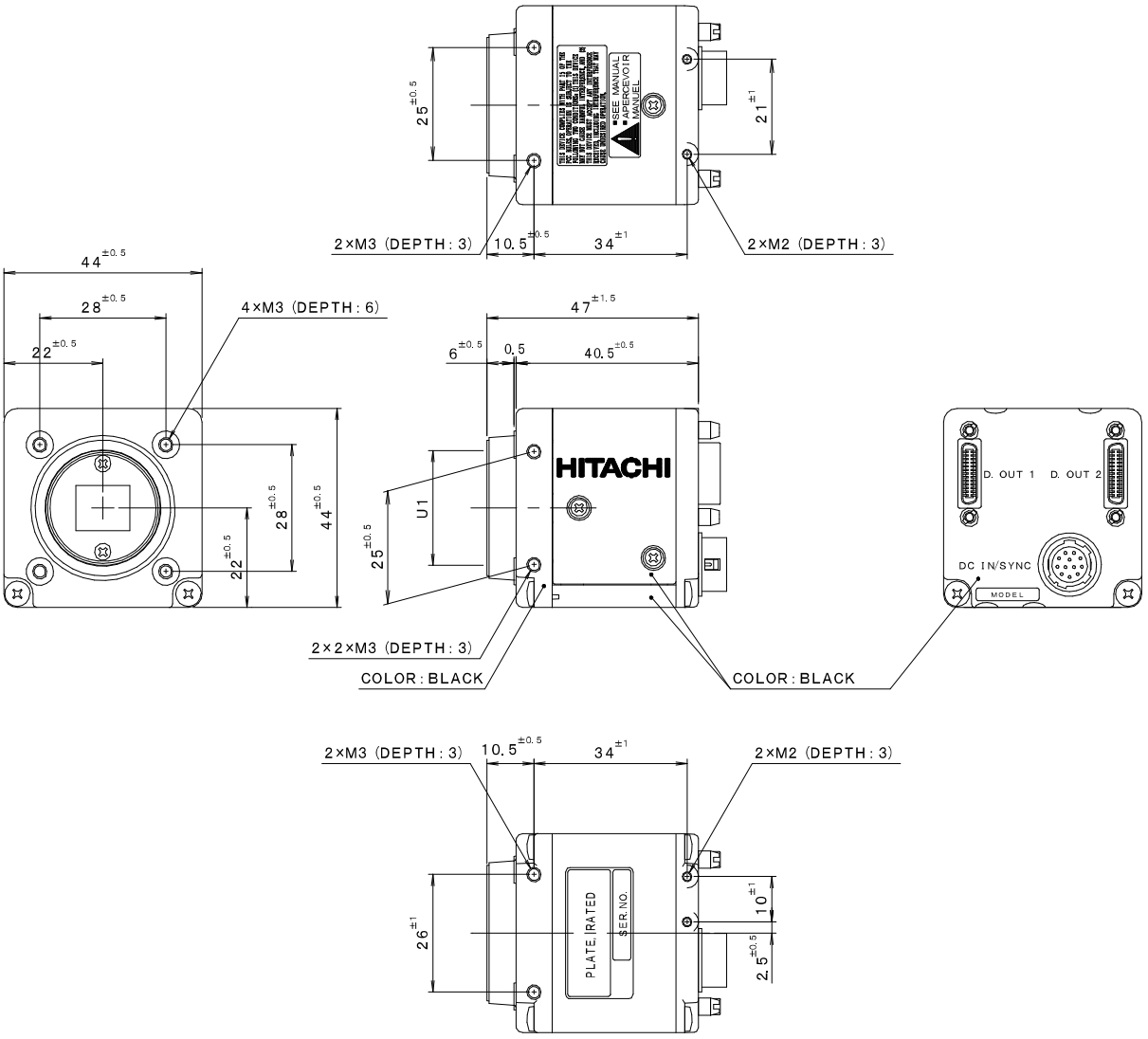
	SORT OFF	SORT ON
①	(14 + Width + (2067 - Width/4)) H or more	
②	(8 + Start/4)H	(9 + Start/4)H
③	(Width)H	

9. Spectral response



10. External view

- MASS : APPROX 110 g
- UNIT : mm
- SCALE : NTS



DWG. No. **E400192625**

SHEET 24/26

Notice:
These specifications are subject to change without prior notice due to product improvement.
Confirm the most recent specifications at time of order.
Hitachi Kokusai certifies this product complies with the standard warranty conditions of Hitachi Kokusai, and that quality control is implemented to the extent required to comply with these conditions.

RoHS Compliant
This product complies with the requirement of the RoHS(Restriction of the use of Certain Hazardous Substances in Electrical and Electronic Equipment) Directive 2002/95/EC

Warranty and service:

(1) The guarantee period is one year after the data purchase.
However, the defects due to erroneous use or intentional act are excluded.
(2) As the defect after expiration of the guarantee period, where product repair is possible, repair will be performed at charge.
(3) The present Warranty pertains only to the camera unit. Secondary malfunctions attributable to camera failure as well as expenses incurred by disassembly and reassembly of the related system, are beyond the scope of this Warranty.
(4) Compensation for loss of business, loss or damage to software, database and other contingent losses are beyond the scope of this Warranty.
(5) Hitachi Kokusai Electric Inc. is not liable for the losses caused when the equipment is used in a system, use for business trades, production process, medical fields, crime prevention applications, etc.
(6) In the case of camera trouble by miss wiring of cable, it will be considered as out of warranty.

Modification history

SIMBLE	DATE	CORRECTION AND REASONS		DESIGNED